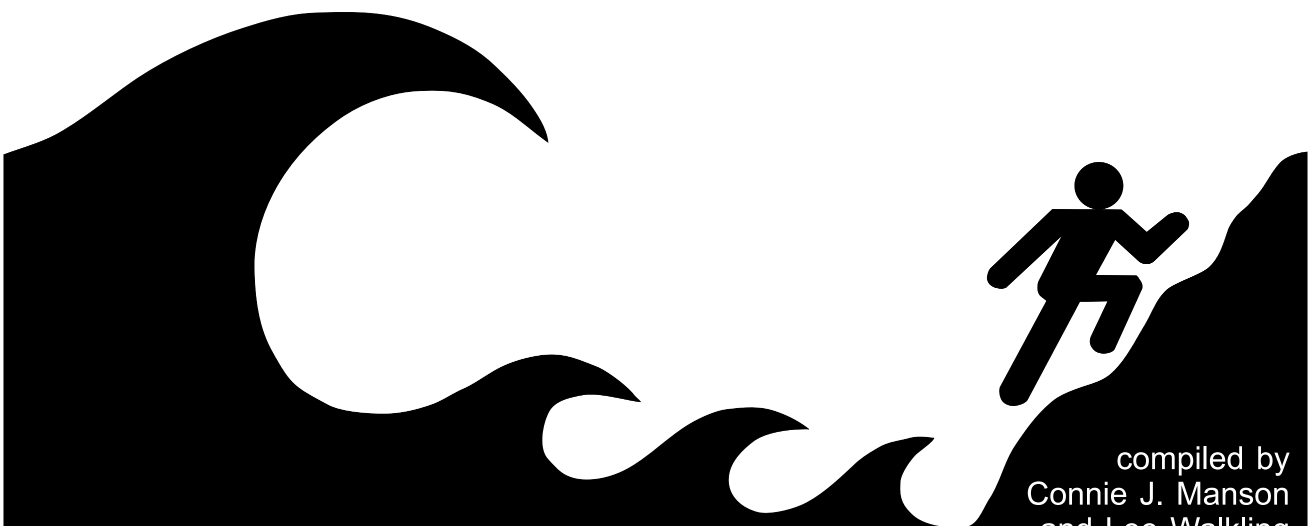
NATURAL RESOURCES

Tsunamis on the Pacific Coast of Washington State and Adjacent Areas—A Selected, Annotated Bibliography and Directory



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Contents

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INTRODUCTION

This report intends to help local planners and emergency managers understand the earthquake and tsunami risks on the Pacific coast and mitigate their effects. The Pacific coast of Washington is at risk from tsunamis. These destructive waves can be caused by coastal or submarine landslides or volcanism, but they are most commonly caused by large submarine earthquakes.

Tsunamis are generated when these geologic events cause large, rapid movements in the sea floor that displace the water column above. That swift change creates a series of high-energy waves that radiate outward like pond ripples. Offshore tsunamis would strike the adjacent shorelines within minutes and also cross the ocean at speeds as great as 600 miles per hour to strike distant shores. In 1946, a tsunami was initiated by an earthquake in the Aleutian Islands of Alaska; in less than 5 hours, it reached Hawaii with waves as high as 55 feet and killed 173 people.

Tsunami waves can continue for hours. The first wave can be followed by others a few minutes or a few hours later, and the later waves are commonly larger. The first wave to strike Crescent City, California, caused by the Alaska earthquake in Prince William Sound in 1964, was 9 feet above the tide level; the second, 29 minutes later, was 6 feet above tide, the third was about 11 feet above the tide level, and the fourth, most damaging wave was more than 16 feet above the tide level. The third and fourth waves killed 11 people. Estimates of the damage range from $7.4 to $16 million (in 1964 dollars). That same tsunami destroyed property in many areas along the coast from Alaska to California. In Washington alone, that tsunami caused $105,000 (in 1964 dollars) in damage.

That 1964 event was the most recent significant tsunami to reach the Washington coast, but recent geologic investigations indicate that large tsunamis have struck our coast many times in the last few thousand years.

On the Pacific coast, from southern British Columbia to northern California, people and property are at risk both from distantly and locally generated tsunamis. Recent studies indicate that about a dozen very large earthquakes (with magnitudes of 8 or more) have occurred in the Cascadia subduction zone west of Washington. Computer models indicate that tsunamis waves generated by these local events might range from 5 to 55 feet in height and could affect the entire coastal region. (See Section IX, Tsunami models and modeling.)

Warnings

When an earthquake that might generate a Pacific coast tsunami is detected, the Alaska Tsunami Warning Center calculates the danger to the northeast Pacific coast and notifies the communities at risk. Those warnings may give people a few hours to prepare and evacuate (depending on the distance to the earthquake).

If the earthquake occurs off our coast, however, there may be no time to send out hazard warnings. The first waves could arrive within minutes of the earthquake. The only tsunami warning might be the earthquake itself.

Mitigation

In order to plan for hazards, citizens need to know what to expect. In the last few years, there have been significant advances in understanding the earthquakes that have occurred on the Cascadia subduction zone and the tsunamis that have struck the Pacific coast. This information is the foundation for planning efforts.

In order to form successful mitigation strategies, local planners and emergency managers need to know what has worked and what has not. In the last few years, many organizations and communities have addressed these issues. Those experiences can help others to formulate the best possible plans for the coastal communities.

ORGANIZATION

The information is presented in three parts. The Bibliography (compiled by Connie Manson) is an annotated list of highly selected materials about tsunami hazards and closely related literature. The annotations are brief descriptions of the works, some quoted from their introductory sections. The qualitative assessments were made by the compiler, from her knowledge of the use and usefulness of the reports. The Directory (compiled by Lee Walkling) lists the people and organizations actively involved with tsunami research in the Pacific Northwest. The Internet Access section gives the addresses for tsunami-related web pages, as of early 1998.

All the materials listed here are available for examination at the DGER offices in Olympia, Washington. Many are also available at university or public libraries.

Acknowledgments

This work was prepared at the Washington Department of Natural Resources, Division of Geology and Earth Resources, in cooperation with the Washington Military Department, Emergency Management Division, and the Federal Emergency Management Agency.

Bibliography

I. MOST SIGNIFICANT REPORTS

These are the most highly recommended readings for the entire tsunami mitigation community:

Atwater, B. F., 1996, Coastal evidence for great earthquakes in western Washington. *In* Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., editors, Assessing earthquake hazards and reducing risk in the Pacific Northwest: U.S. Geological Survey Professional Paper 1560, p. 77-90.

A thorough review of the geologic evidence of great earthquakes on the Cascadia subduction zone. Excellent, highly accessible illustrations.

California Governor's Office of Emergency Services, 1997, Findings and recommendations for mitigating the risks of tsunamis in California: California Governor's Office of Emergency Services, 30 p.

An action plan for tsunami mitigation in California.

Good, J. W., 1995, Tsunami education planning workshop findings and recommendations: U.S. National Oceanic and Atmospheric Administration Pacific Marine Environmental Laboratory NOAA Technical Memorandum ERL PMEL-106, 41 p.

Recommends specific actions to improve public awareness and agency cooperation.

Hull, D. A.; Karel, Angie, 1997, Strategy for tsunami mitigation and public awareness: Oregon Department of Geology and Mineral Industries, 1 v.

Addresses the tsunami mitigation and public awareness efforts in Oregon.

Tsunami Hazard Mitigation Federal/State Working Group, 1996, Tsunami hazard mitigation implementation plan—A report to the Senate Appropriations Committee: Tsunami Hazard Mitigation Federal/State Working Group, 1 v.

This is the "action plan" for the state-federal tsunami working group.

Walker, D. A., 1996, Human factors compounding the destructiveness of future tsunamis: Science of Tsunami Hazards, v. 14, no. 2, p. 79-83.

Makes strong arguments for improving public awareness of the hazards and improved communication among the public, the scientists, and government agencies as the best ways to reduce the disastrous effects of tsunamis.

II. GENERAL WORKS ABOUT THE GEOLOGY AND GEOLOGIC HAZARDS OF WASHINGTON

Alt, D. D.; Hyndman, D. W., 1995, Northwest exposures—A geologic story of the Northwest: Mountain Press Publishing Company [Missoula, Mont.], 443 p.

The geology of the Pacific Northwest, intended for a popular audience. Includes a brief section on Pacific coast earthquakes and tsunamis (p. 399-401).

Cope, Vern, 1994, The Washington earthquake handbook—An easy-to-understand information and survival manual: Vern Cope [Portland, Ore.], 145 p.

A good, general review of earthquake and tsunami hazards in Washington. Very good sections on earthquake preparedness and emergency information.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Lasmanis, Raymond, 1991, The geology of Washington: Rocks and Minerals, v. 66, no. 4, p. 262-277.

A good, brief, recent overview of Washington's extremely diverse geology. Includes a discussion of the earthquake hazards of the Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and high school libraries.

Noson, L. L.; Qamar, A. I.; Thorsen, G. W., 1988, Washington State earthquake hazards: Washington Division of Geology and Earth Resources Information Circular 85, 77 p.

An excellent, thorough discussion of earthquake and tsunami hazards in Washington.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

Orr, E. L.; Orr, W. N., 1996, Geology of the Pacific Northwest: McGraw-Hill Companies, Inc., 409 p.

College-level text. Includes a very brief discussion of tsunami hazards.

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., editors, 1996, Assessing earthquake hazards and reducing risk in the Pacific Northwest: U.S. Geological Survey Professional Paper 1560, 306 p., 6 plates.

This volume includes eleven highly significant papers about earthquakes in the Pacific Northwest.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Includes:

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., 1996, Earthquake hazards in the Pacific Northwest—An overview. p. 1-54.

The introduction to the volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Walsh, T. J., 1996, An introduction to earthquakes sources of the Pacific Northwest. p. 71-74.

Discusses the general earthquake setting in the Pacific Northwest and summarizes the findings of papers in this volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

III. GENERAL WORKS ABOUT GEOLOGIC HAZARDS, EARTHQUAKES, AND TSUNAMIS

Alexander, David, 1993, Natural disasters: Chapman and Hall, 632 p.

A thorough examination of the causes and actions of various geologic hazards, including earthquakes and tsunamis, their impacts on people and society, and the responses and preventive measures we can make.

American Institute of Professional Geologists, 1993, The citizens' guide to geologic hazards—A guide to understanding geology hazards—Including asbestos, radon, swelling soils, earthquakes, volcanoes, landslides, subsidence, floods and coastal hazards: American Institute of Professional Geologists, 134 p.

An excellent review of hazards from geologic materials (like asbestos and radon) and geologic processes (including earthquakes, landslides, and tsunamis). Clearly written, with good illustrations and current information.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Bernard, E. N., editor, 1991, Tsunami hazard: Natural Hazards, v. 4, no. 2-3, p. 113-326.

Recent advances in tsunami research are published in this special issue of Natural Hazards (the proceedings of the 14th International Tsunami Symposium, 1989). The scientific reports are grouped into three areas of research: observations, physical processes, and hazard mitigation.

Bernard, E. N., 1997, Reducing tsunami hazards long U.S. coastlines. *In* Hebenstreit, G. T., editor, Perspectives on tsunami hazard reduction: Kluwer Academic Publishers, p. 189-203.

A summary of workshops held by NOAA after a series of earthquakes on the southern Cascadia subduction zone. Those workshops focused on tsunami hazard assessment, tsunami warnings, and tsunami education, with twelve recommendations that participants felt would mitigate the tsunami hazards.

Highly recommended for local planners, emergency managers, and college libraries.

Bolt, B. A., 1988, Earthquakes: W. H. Freeman and Company, 282 p.

A standard work about the causes and effects of earthquakes.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Bourgeois, Joanne; Minoura, Koji, 1997, Paleotsunami studies—Contribution to mitigation and risk assessment. *In* Gusiakov, V. K., editor, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, p. 1-4.

This paper reviews the rapid recent advances in recognizing and interpreting paleotsunami deposits. These attempts can contribute directly to tsunami-mitigation and risk assessment programs.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Brennan, A. M.; Lander, J. F., editors, 1991, 2nd UJNR Tsunami Workshop, Honolulu, Hawaii, 5–6 November 1990; Proceedings: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 24, 260 p.

These papers discuss tsunami modeling and protective measures.

The full volume is recommended for modelers and engineers. The "protective measures" section is recommended for local planners, emergency managers, and college libraries.

Camfield, F. E., 1980, Tsunami engineering: U.S. Army Corps of Engineers Coastal Engineering Research Center Special Report 6, 222 p.

A thorough discussion of the engineering aspects of tsunami wave motion and coastal barrier design.

Recommended for coastal engineers and architects.

Clague, J. J., 1991, Natural hazards. *In* Gabrielse, H.; Yorath, C. J., editors, Geology of the Cordilleran orogen in Canada: Geological Survey of Canada Geology of Canada 4; Geological Society of America DNAG Geology of North America, v. G-2, p. 803-815.

An overview of the earthquake, landslide, tsunami, and volcanic hazards in western Washington and British Columbia.

Curtis, G. D.; Pelinovsky, E. N., 1997, Methods of calculation of tsunami risk. *In* Gusiakov, V. K., editor, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, p. 28-31.

A brief but thoughtful discussion of the complex components in tsunami risk estimates.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

Dawson, A. G., 1994, Geomorphological effects of tsunami run-up and backwash: Geomorphology, v. 10, no. 1-4, p. 83-94.

Tsunamis can cause rapid changes in shorelines; evolution of some portions of shorelines may even be dominated by tsunami erosion and deposition. This paper includes many international examples of such tsunami-caused geomorphic changes, with a brief discussion of the 300-ybp event on the Pacific coast of Washington and Oregon and the 1,100-ybp event in the Puget Lowland.

Dudley, W. C.; Lee, Min, 1988, Tsunami!: University of Hawaii Press, 132 p.

This volume gives eyewitness accounts of the 1946, 1952, 1957, and 1960 tsunamis and clear descriptions of the causes, actions and effects of tsunami waves.

Recommended for high school and public libraries.

El-Sabh, M. I., 1995, The role of public education and awareness in tsunami hazard management. *In* Tsuchiya, Yoshito; Shuto, Nobuo, editors, Tsunami—Progress in prediction, disaster prevention and warning: Kluwer Academic Publishers Advances in Natural and Technological Hazards Research, v. 4, p. 277-285.

Addresses the role of public education and awareness as an important element in tsunami hazard management. Highly recommended for local planners, emergency managers, and college libraries.

Gusiakov, V. K., editor, 1997, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, 68 p.

Includes 10 papers presented in 1996, with topics ranging from paleotsunami research to risk assessment.

Highly recommended for geologists, local planners, emergency managers, public libraries, and high school and college libraries.

Hays, W. W., editor, 1981, Facing geologic and hydrologic hazards—Earth-science considerations: U.S. Geological Survey Professional Paper 1240-B, 109 p.

Basic information about the geologic hazards of earthquakes, floods, ground failures, and volcanic eruptions with suggested actions that planners and decision-makers can take to reduce losses from geologic and hydrologic hazards.

Recommended for local planners, emergency managers, public libraries, and high school /college libraries.

Hunt, Joe, 1992, Tsunami warning!: Intergovernmental Oceanographic Commission, 32 p.

An illustrated book about tsunamis, suitable for 2nd to 4th grades.

Recommended for school and public libraries.

Lampton, Christopher, 1992, Tidal wave: Millbrook Press, 63 p.

A basic, recent work about tsunamis, suitable for 4th to 8th grades. Well illustrated.

Recommended for school and public libraries.

Lander, J. F.; Yeh, Harry, conveners, 1995, Report of the International Tsunami Measurements Workshop: International Tsunami Measurements Workshop, 102 p.

Includes discussions and recommendations for instrumentation, modeling, and mitigation.

Recommended for local planners and emergency managers.

Lockridge, P. A., 1990, Nonseismic phenomena in the generation and augmentation of tsunamis: Natural Hazards, v. 3, no. 4, p. 403-412.

Discusses the tsunamis caused by volcanoes, landslides, and other non-seismic events and how those risks can be mitigated through education and warning systems.

McCredie, Scott, 1994, Tsunamis—The wrath of Poseidon; When nightmare waves appear out of nowhere to smash the land: Smithsonian, v. 24, no. 12, p. 28-39.

Popular article about tsunami hazards, damage, and generation. Clearly written and well illustrated.

Recommended for local planners, emergency managers, public libraries, and high school libraries.

McCulloch, D. S., 1985, Evaluating tsunami potential. *In* Ziony, J. I., editor, Evaluating earthquake hazards in the Los Angeles region—An earth-science perspective: U.S. Geological Survey Professional Paper 1360, p. 375-413.

Excellent technical overview. Descriptions and illustrations of tsunami-wave propagation and runup are especially useful.

Recommended for engineers, local planners, and college libraries.

Nance, J. J., 1988, On shaky ground: William Morrow and Company, Inc., 416 p.

A popular work about earthquake hazards of the U.S., with emphasis on the Pacific Northwest.

Recommended for public libraries.

Nelson, J. B., 1980, Catalog of tsunami photographs: U.S. National Oceanic and Atmospheric Administration Key to Geophysical Records Documentation 13, 52 p.

Photographs of tsunami damage from 9 events, from 1946 to 1975, including the damage along the Pacific coast caused by the 1964 Alaska earthquake. Copies of the individual photographs are available for sale; ordering information is included.

Nichols, D. R.; Buchanan-Banks, J. M., 1974, Seismic hazards and land-use planning: U.S. Geological Survey Circular 690, 33 p.

Describes the hazards caused by earthquakes, including tsunamis, ground shaking, and earthquake-induced landslides and their application to land-use planning. Includes a list of the principal sources of geologic and seismic data. Although dated, this is still useful.

Recommended for local planners and public libraries.

Oppenheimer, D. H.; Bittenbinder, A.; Bogaert, B.; Dietz, L.; Ellsworth, W.; Jensen, E.; Kohler, W.; Van Schlaack, J.; Buland, R.; Benz, H. M.; and others, 1997, CREST—Consolidated Reporting of EarthquakeS and Tsunamis [abstract]: Eos (American Geophysical Union Transactions), v. 78, no. 46, Supplement, p. F46.

A brief description of the NOAA-sponsored earthquake-sensing instrumentation system.

Pararas-Carayannis, George, 1988, Tsunami warning system in the Pacific—An example of international cooperation. *In* El-Sabh, M. I.; Murty, T. S., editors, Natural and man-made hazards; Proceedings of the international symposium held at Rimouski, Quebec, 1986: D. Reidel Publishing Co., p. 773-780.

Prior to 1960, the U.S., Japan, and other countries around the Pacific Ocean maintained their own independent tsunami warning systems. The widespread damage caused by the 1964 Alaska earthquake focused attention on the need for an international system, described here.

Recommended for local planners and emergency managers.

Preuss, Jane, 1984, Comprehensive planning in tsunami prone areas. *In* Proceedings of the 8th World Conference on Earthquake Engineering: Prentice-Hall, Inc., v. 7, p. 793-800.

An excellent summary of land-use planning in tsunami-prone areas.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Siegel, G. B.; Bjur, D. M., 1985, Earthquake mitigation management for harbors and seaports: University of Southern California School of Public Administration, 261 p.

Seaports are at particular risk from coastal-area earthquakes, both from potential tsunami inundation and earthquake-induced liquefaction. Many Pacific coast and Puget Lowland port facilities were originally constructed by filling and/or dredging—practices that have increased their liquefaction susceptibility. While new port construction usually requires geotechnical analysis and design, few older structures are retrofitted.

Recommended for port officials, building code officials, local planners, emergency managers.

Sokolowski, T. J., 1991, Improvements in the Tsunami Warning Center in Alaska: Earthquake Spectra, v. 7, no. 3, Aug. 1991, p. 461-481.

Describes the Alaska Tsunami Warning Center's highly automated tsunami warning system. The center analyzes data from potential tsunamigenic earthquakes in real time and disseminates critical information to affected coastal populations via satellite and high-speed teletypewriter communication systems. These upgraded systems provide timely and effective tsunami warning services for coastal populations in Alaska and the west coasts of Canada and the U.S.

Steinbrugge, K. V., 1982, Earthquakes, volcanoes, and tsunamis—An anatomy of hazards: Skandia America Group, 392 p.

A thorough examination of earthquakes, volcanoes, and tsunamis, with emphasis on their insurance risk.

Thorsen, G. W., 1994, Earthquake preparedness—When you're not at home: Washington Geology, v. 22, no. 3, p. 35-38.

An excellent review of safety tips in earthquake- and tsunami-prone areas.

Highly recommended for coastal businesses, local planners, and emergency managers.

Tiedemann, Herbert, 1992, Earthquakes and volcanic eruptions—A handbook on risk assessment: Swiss Reinsurance Company, 951 p.

An exhaustive examination of earthquakes, volcanoes, and tsunamis, with emphasis on their insurance risk. Includes recent examples.

Tsuchiya, Yoshito; Shuto, Nobuo, editors, 1995, Tsunami—Progress in prediction, disaster prevention and warning: Kluwer Academic Publishers Advances in Natural and Technological Hazards Research, v. 4, 336 p.

Papers presented at a conference. Includes sections on tsunami generation and prediction; a lengthy section on tsunami mitigation, and a section on tsunami warning systems.

Recommended for tsunami scientists, local planners, and emergency managers.

Tsunami Hazard Mitigation Federal/State Working Group, 1996, Tsunami hazard mitigation implementation plan—A report to the Senate Appropriations Committee: Tsunami Hazard Mitigation Federal/State Working Group, 1 v.

This is the “action plan” for the state-federal tsunami working group.

Required reading for all tsunami researchers and planners.

U.S. National Oceanic and Atmospheric Administration, 1986, Tsunamis slide set: U.S. National Oceanic and Atmospheric Administration World Data Center-A, 20 photographic slides, in folder with 4 p. text.

These 35mm slides of tsunami waves and their resulting damage cover seven events occurring during the period 1946 to 1975, including the tsunami damage in Prince William Sound caused by the 1964 Alaska earthquake. Copies of the slide set are available for sale; ordering information is included.

Walker, D. A., 1996, Human factors compounding the destructiveness of future tsunamis: Science of Tsunami Hazards, v. 14, no. 2, p. 79-83.

Makes strong arguments for improving public awareness of the hazards and improved communication among the public, the scientists, and government agencies as the best ways to reduce the disastrous effects of tsunamis. Required reading for all tsunami researchers and planners.

IV. WORKS ABOUT EARTHQUAKE AND TSUNAMI HAZARDS ON THE PACIFIC COAST OF WASHINGTON

Atwater, B. F., 1987, Evidence for great Holocene earthquakes along the outer coast of Washington State: Science, v. 236, no. 4804, p. 942-944.

Describes geologic evidence for great earthquakes along the Pacific coast of Washington State: repeated episodes of the rapid subsidence of vegetated coastal areas topped with what appear to be tsunami-generated sand layers. An early, seminal study of evidence of great earthquakes along the Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Atwater, B. F., 1992, Geologic evidence for earthquakes during the past 2,000 years along the Copalis River, southern coastal Washington: Journal of Geophysical Research, v. 97, no. B2, p. 1901-1919.

A thorough examination of the evidence for several prehistoric earthquakes in deposits in the Copalis River estuary, WA.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Atwater, B. F.; Nelson, A. R.; Clague, J. J.; Carver, G. A.; Yamaguchi, D. K.; Bobrowsky, P. T.; Bourgeois, Joanne; Palmer, S. P.; and others, 1995, Summary of coastal geologic evidence for past great earthquakes at the Cascadia subduction zone: Earthquake Spectra, v. 11, no. 1, p. 1-18.

A thorough review of the geologic evidence of great earthquakes on the Cascadia subduction zone, from the research conducted from 1985 through 1995. Includes an excellent bibliography.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Berkman, S. C.; Symons, J. M., 1960?, The tsunami of May 22, 1960 as recorded at tide stations: U.S. Coast and Geodetic Survey, 69 p.

Tide gage readings for this tsunami from around the Pacific Ocean, including the stations at Neah Bay, Friday Harbor, and Echo Bay.

Bucknam, R. C.; Leopold, E. B.; Hemphill-Haley, Eileen; Ekblaw, D. E.; Atwater, B. F.; Benson, B. E.; Phipps, J. B., 1994, Holocene tectonics in western Washington. *In* Swanson, D. A.; Haugerud, R. A., editors, Geologic field trips in the Pacific Northwest: University of Washington Department of Geological Sciences, v. 2, p. 2C 1-15.

Guidebook for field trips to specific locations in the Puget Lowland and the Pacific coast that have evidence of ancient earthquakes.

Highly recommended for geologists, local planners, government officials, and emergency managers. Should be held at public and college libraries.

Good, J. W., 1995, Tsunami education planning workshop findings and recommendations: U.S. National Oceanic and Atmospheric Administration Pacific Marine Environmental Laboratory NOAA Technical Memorandum ERL PMEL-106, 41 p.

Recommends specific actions to improve public awareness and agency cooperation.

Required reading for all tsunami-area local planners and emergency managers; should be deposited in all tsunami-area public and college libraries.

Good, J. W.; Ridlington, S. S., editors, 1992, Coastal natural hazards—Science, engineering, and public policy: Oregon Sea Grant Program, 162 p.

Excellent papers about coastal hazards from earthquakes, tsunamis, landslides, and erosion, as well as papers about coastal engineering and public policy. Focuses on the Pacific coast of Oregon, with applications to the entire Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Heaton, T. H.; Hartzell, S. H., 1987, Earthquake hazards on the Cascadia subduction zone: Science, v. 236, no. 4798, p. 162-168.

An overview of the potential seismic hazard from large subduction earthquakes on the Cascadia subduction zone. An early, seminal study giving evidence of great earthquakes along the Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Heaton, T. H.; Kanamori, Hiroo, 1984, Seismic potential associated with subduction in the northwestern United States: Seismological Society of America Bulletin, v. 74, no. 3, p. 933-941.

An early, seminal study discussing the possibility of great earthquakes along the Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Heaton, T. H.; Snavely, P. D., Jr., 1985, Possible tsunami along the northwestern coast of the United States inferred from Indian traditions: Seismological Society of America Bulletin, v. 75, no. 5, p. 1455-1460.

Briefly discusses Judge James Swan's 1868 account of the Makah's tradition of a great flood at Neah Bay and the possibility that it was a tsunami.

Recommended for local planners, emergency managers, public libraries, and high school/college libraries.

Hebenstreit, G. T.; Murty, T. S., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America; Part 1—The outer coast: Marine Geodesy, v. 13, no. 2, p. 101-146.

A computer model of the maximum size of tsunamis generated by earthquakes along the Pacific coasts of British Columbia, Washington, and Oregon. The results showed that large tsunami amplitudes can occur on the outer coast.

Recommended for local planners, emergency managers, and college libraries.

Hemphill-Haley, Eileen, 1995, Diatom evidence for earthquake-induced subsidence and tsunami 300 yr ago in southern coastal Washington: Geological Society of America Bulletin, v. 107, no. 3, p. 367-378.

These single-celled aquatic plants in tsunami deposits provide compelling new evidence for tsunami research.

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These single-celled aquatic plants in tsunami deposits provide compelling new evidence for tsunami research.

Hogan, D. W.; Whipple, W. W.; Lundy, C., 1964, Tsunami of 27 and 28 March, 1964, State of Washington coastline: U.S. Army Corps of Engineers unpublished file report, 29 p.

Original Corps of Engineers field data of waves heights along the Washington coast from the 1964 tsunami.

Recommended for local planners, emergency managers, and college libraries.

Houston, J. R., 1979, State-of-the-art for assessing earthquake hazards in the United States; Report 15, Tsunamis, seiches, and landslide-induced water waves: U.S. Army Engineer Waterways Experiment Station Miscellaneous Paper S-73-1, 88 p.

The hydrodynamic consequences from tsunamis, seiches, and landslide-induced water waves in the U.S. Focuses on distantly generated tsunamis. (Hazards from locally generated earthquakes on the Cascadia subduction zone were not yet recognized when this report was written.)

Recommended for local planners, emergency managers, and college libraries.

Houston, J. R.; Garcia, A. W., 1978, Type 16 flood insurance study—Tsunami predictions for the west coast of the continental United States: U.S. Army Engineer Waterways Experiment Station Technical Report H-78-26, 69 p.

Runup estimates calculated for most of the U.S. Pacific Coast for distantly generated tsunamis.

Recommended for local planners, emergency managers, and college libraries.

Hutchinson, Ian; McMillan, A. D., 1997, Archaeological evidence for village abandonment associated with late Holocene earthquakes at the northern Cascadia subduction zone: Quaternary Research, v. 48, no. 1, p. 79-87.

A thorough archaeological study of village sites on Vancouver Island, the Neah Bay–Cape Flattery area, and coast of the Strait of Juan de Fuca.

Recommended for local planners, emergency managers, and college libraries.

Jacoby, G. C.; Bunker, D. E.; Benson, B. E., 1997, Tree-ring evidence for an A.D. 1700 Cascadia earthquake in Washington and northern Oregon: Geology, v. 25, no. 11, p. 999-1002, Data Depository item 9756.

Careful tree ring dating provides additional evidence that a great Cascadia subduction zone earthquake occurred in 1700.

Jonientz-Trisler, Chris, 1995, Cascadia response to the October 4, 1994 Kurile Islands M_w 8.3 earthquake-induced tsunami warning [abstract]: Eos (American Geophysical Union Transactions), v. 76, no. 17, Supplement, p. S305.

The actions and reactions of communities and officials to the 1994 tsunami warning revealed weaknesses in those systems.

Recommended for local planners and emergency managers.

Kanamori, Hiroo; Heaton, T. H., 1996, The wake of a legendary earthquake: Nature, v. 379, no. 6562, p. 203-204.

A good summary of the evidence for Cascadia subduction zone earthquakes and the 1700 event and tsunami.

Recommended as a first introduction to the subjects.

Kerr, R. A., 1995, Faraway tsunami hints at a really big Northwest quake: Science, v. 267, no. 5200, p. 962.

A general-interest account of the deduction for the date of the 1700 event.

Recommended as an introduction to the subject

Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690–1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, 265 p.

This exhaustive catalog documents tsunamis that struck the U.S. and its territorial possessions since 1690. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for tsunami scientists and college and large public libraries.

Lander, J. F.; Lockridge, P. A.; Kozuch, M. J., 1993, Tsunamis affecting the west coast of the United States, 1806–1992: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 29, 243 p.

This exhaustive catalog documents tsunamis that struck the west coast of the U.S. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for tsunami scientists and college and large public libraries.

Lockridge, P. A., 1988, Historical tsunamis in the Pacific Basin. *In* El-Sabh, M. I.; Murty, T. S., editors, Natural and man-made hazards; Proceedings of the international symposium held at Rimouski, Quebec, 1986: D. Reidel Publishing Co., p. 171-181.

A brief, well-illustrated review of tsunami hazards around the Pacific Ocean in the last 100 years.

Recommended for local planners, emergency managers, and college libraries.

Lockridge, P. A.; Smith, R. H., 1984, Tsunamis in the Pacific Basin, 1900–1983: U.S. National Geophysical Data Center, 1 sheet, scale 1:17,000,000.

Map showing tsunamis around the Pacific Ocean, coded to indicate the type and magnitude of the tsunami-generating source and the size of the run-up. The accompanying tables give the date, location, source region, casualties, and damage of the tsunamis.

Recommended for local planners, emergency managers, and college libraries.

Lockwood, Millington; Elms, J. D.; Lockridge, P. A.; Moore, G. W.; Nishenko, S. P.; Simkin, Tom; Newhall, C. G., 1990, Natural hazards map of the Circum-Pacific region—Pacific Basin sheet: U.S. Geological Survey Circum-Pacific Map Series CP-35, 1 sheet, scale 1:17,000,000, with 31 p. text.

Map showing hazards from tsunamis, earthquakes, volcanoes, and storms for the Circum-Pacific region.

Recommended for local planners, emergency managers, and college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Numerical simulation of tsunami amplitudes on the coast of British Columbia due to local earthquakes: Science of Tsunami Hazards, v. 8, no. 2, p. 97-127.

Thorough, detailed report of computer simulations of tsunamis along the Pacific Coast, the Strait of Juan de Fuca, and Puget Sound.

Recommended for engineers and for college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Simulation of tsunamis from great earthquakes on the Cascadia subduction zone: Science, v. 250, no. 4985, p. 1248-1251.

A computer model of a tsunami generated by a hypothetical earthquake of magnitude 8.5 off Washington and British Columbia. The calculations quantify the tsunami risk and identify the factors that would determine flooding levels along the adjacent coast, the Strait of Georgia, and Puget Sound.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Oregon Geology, 1997, Center for the Tsunami Inundation Mapping Effort (TIME) dedicated at Hanfield Maine Science Center in Newport: Oregon Geology, v. 59, no. 4, p. 96-97.

News report on the opening of this research center, with information about the funding and administration of the tsunami research efforts.

Peterson, C. D.; Priest, G. R., 1996, Paleotsunami barrier-overtopping—One piece of the puzzle [abstract]: Oregon Geology, v. 58, no. 4, p. 96-97.

Brief report on tsunami waves that top coastal barriers, such as dunes.

Peterson, C. D.; Priest, G. R., 1992, Catastrophic coastal hazards in the Cascadia margin U.S. Pacific Northwest. *In* Good, J. W.; Ridlington, S. S., editors, Coastal natural hazards—Science, engineering, and public policy: Oregon Sea Grant Program, p. 33-37.

Describes coastal hazards from the effects of a great subduction zone earthquake (subsidence, liquefaction, and tsunami inundation), as well as beach erosion by storms. Emphasizes the need for site-specific information for hazard mitigation.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Preuss, Jane, 1987, Coastal high hazard mitigation—Comprehensive planning for areas vulnerable to tsunamis. *In* Association of State Floodplain Managers, Realistic approaches to better floodplain management; 11th annual conference, Proceedings: University of Colorado Natural Hazards Information Center Special Publication 18, p. 317-322.

Describes a risk-based urban planning approach that balances the needs of industrial and resort waterfront activities with safety and preparedness requirements. Gives examples from Alaskan and Mexican cities damaged by tsunamis, with applications to Washington coastal towns.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Preuss, Jane; Hebenstreit, G. T., 1991, Integrated hazard assessment for a coastal community—Grays Harbor: U.S. Geological Survey Open-File Report 91-441-M, 36 p.

In this case study of an earthquake-generated tsunami at Grays Harbor, the authors develop and apply a methodology for an integrated hazard assessment. The tsunami is treated as the initiator of a suite of interrelated hazards. An integrated approach can provide relatively accurate loss estimates, and subsequent mitigation efforts can be conducted with accuracy and effectiveness.

Highly recommended for local planners, emergency managers, public libraries, and college libraries.

Reinhart, M. A., 1991, Sedimentological analysis of postulated tsunami-generated deposits from Cascadia great-subduction earthquakes along southern coastal Washington: University of Washington Master of Science unpublished report, 77 p., plus appendixes.

Thorough technical analysis of the stratigraphy of shoreline sediments that could indicate tsunami-related flooding in the past 1,000 years at Willapa Bay.

Recommended for college libraries and for engineers and geologists.

Reinhart, M. A.; Bourgeois, Joanne, 1995, A paleohydraulic reconstruction of 300-year-old tsunami deposits at Willapa Bay, Washington State [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 26.

Brief report that 300-year-old sand sheets at Willapa Bay were more likely deposited by tsunamis than by storm surges.

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., editors, 1996, Assessing earthquake hazards and reducing risk in the Pacific Northwest: U.S. Geological Survey Professional Paper 1560, 306 p., 6 plates.

This volume includes eleven highly significant papers about earthquakes in the Pacific Northwest.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Includes:

Atwater, B. F., 1996, Coastal evidence for great earthquakes in western Washington. p. 77-90.

A thorough review of the geologic evidence of great earthquakes on the Cascadia subduction zone. Excellent, highly accessible illustrations.

Required reading for geologists, local planners, emergency managers; should be deposited in public and college libraries.

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., 1996, Earthquake hazards in the Pacific Northwest—An overview. p. 1-54.

The introduction to the volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Walsh, T. J., 1996, An introduction to earthquakes sources of the Pacific Northwest. p. 71-74.

Discusses the general earthquake setting in the Pacific Northwest and summarizes the findings of papers in this volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Satake, Kenji; Bourgeois, Joanne; Reinhart, M. A., 1994, Tsunami heights in the Pacific Northwest from Cascadia subduction earthquakes. *In* Prentice, C. S.; Schwartz, D. P.; Yeats, R. S., conveners, Proceedings of the Workshop on Paleoseismology, 18–22 September 1994, Marshall, California: U.S. Geological Survey Open-File Report 94-568, p. 163-165.

Computations of crustal deformation and tsunamis for four hypothetical great earthquakes along the Cascadia subduction zone. The model indicates wave heights of more than 10 meters in some areas from a M9 event. Those computations were then compared to the geologic evidence of paleo-tsunamis in coastal and estuarine sediments in southwest Washington.

Satake, Kenji; Shimazaki, Kunihiko; Tsuji, Yoshinobu; Ueda, Kazue, 1996, Time and size of a giant earthquake in Cascadia inferred from Japanese tsunami records of January 1700: Nature, v. 379, no. 6562, p. 246-249.

From careful analysis of historical records of tsunami inundation in Japan, this report points to a precise time for the most recent major event on the Cascadia subduction zone: about 9 p.m., January 26, 1700.

Highly recommended for local planners and emergency managers; should be held at public and college libraries.

Schatz, C. E., 1965, Source and characteristics of the tsunami observed along the coast of the Pacific Northwest on March 28, 1964: Oregon State University Master of Science thesis, 39 p.

The mechanism and effects of the 1964 tsunami along the Pacific Coast.

Recommended for local planners, emergency managers, and college libraries.

Sokolowski, T. J., 1996, Realignment of services in the Tsunami Warning System [abstract]: PanPacific Hazard ‘96, Abstracts [downloaded Sept. 28, 1996, from http://hoshi.cic.sfu.ca/~anderson/hazards96/], 1 p.

Description of recent technical enhancements at the Alaska Tsunami Warning Center.

Synolakis, C. E., 1995, Tsunami prediction [letter]: Science, v. 270, no. 5233, p. 15-16.

A letter questioning the validity of the model indicating that the Japanese tsunami of 1700 was caused by an event on the Cascadia subduction zone.

Recommended for tsunami modelers.

Synolakis, C. E.; Liu, Philip; Carrier, George; Yeh, Harry, 1997, Tsunamigenic sea-floor deformations: Science, v. 278, no. 5338, p. 598-600.

Describes some of the variables that complicate tsunami modeling, as presented at a 1997 workshop.

Recommended for tsunami modelers.

Thorsen, G. W., 1988, Overview of earthquake-induced water waves in Washington and Oregon: Washington Geologic Newsletter, v. 16, no. 4, p. 9-18.

An excellent article about the historic damage and the potential hazard from tsunamis in Washington and Oregon.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

University of Washington Quaternary Research Center, 1995, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, 37 p.

Summaries of the 29 papers presented at this 1995 conference.

Urban Regional Research, 1988, Planning for risk—Comprehensive planning for tsunami hazard areas: National Science Foundation, 246 p.

A thorough examination of land-use planning in tsunami risk areas. Includes chapters on risk assessment, risk reduction, and implementation. Gives examples from tsunamis experiences in Alaska and Mexico, and others areas (including Grays Harbor).

Highly recommended for local planners, emergency managers, public libraries, and college libraries.

Washington Highways, 1964, Tidal wave rips coast, highways: Washington Highways, v. 11, no. 5, p. 2-3.

Report of the damage along the Washington coast from the 1964 tsunami.

Recommended for local planners, emergency managers, public libraries, high school/college libraries.

Whitmore, P. M., 1993, Expected tsunami amplitudes and currents along the North American coast for Cascadia subduction zone earthquakes: Natural Hazards, v. 8, no. 1, p. 59-73.

Estimates of tsunami wave heights for 131 sites along the North American coast for tsunamis generated by Cascadia subduction zone earthquakes.

Recommended for tsunami modelers.

Whitmore, P. M.; Sokolowski, T. J., 1996, Predicting tsunami amplitudes along the North American coast from tsunamis generated in the northwest Pacific Ocean during tsunami warnings: Science of Tsunami Hazards, v. 14, no. 3, p. 147-166.

Estimates of tsunami wave heights on the Pacific coast from earthquakes in Japan and other areas of the northwestern Pacific Ocean.

Recommended for tsunami modelers.

Witten, Don, 1984, Tsunami—A wave like no others: NOAA, v. 14, no. 2, p. 14-17.

A general discussion of the Tsunami Warning System.

V. WORKS ABOUT TSUNAMI HAZARDS IN PUGET SOUND

Atwater, B. F.; Moore, A. L., 1992, A tsunami about 1000 years ago in Puget Sound, Washington: Science, v. 258, no. 5088, p. 1614-1617.

One of six reports in this issue of Science that discuss the paleoseismic evidence for an earthquake about 1,100 years ago on what is now called the Seattle fault. This article describes sand layers in Seattle and on Whidbey Island that may have been deposited by a tsunami generated by that earthquake.

Bourgeois, Joanne; Johnson, S. Y., 1997, Paleoseismologic evidence in the Snohomish delta north of Seattle, Washington State, USA [abstract]: Eos (American Geophysical Union Transactions), v. 78, no. 46, Supplement, p. F441.

Exposed banks in the lower Snohomish River delta between Everett and Marysville show evidence of at least two liquefaction episodes and one tsunami deposit within the last 1,500 years.

Bucknam, R. C.; Leopold, E. B.; Hemphill-Haley, Eileen; Ekblaw, D. E.; Atwater, B. F.; Benson, B. E.; Phipps, J. B., 1994, Holocene tectonics in western Washington. *In* Swanson, D. A.; Haugerud, R. A., editors, Geologic field trips in the Pacific Northwest: University of Washington Department of Geological Sciences, v. 2, p. 2C 1-15.

Guidebook for field trips to specific locations in the Puget Lowland and the Pacific coast that have evidence of ancient earthquakes.

Highly recommended for geologists, local planners, government officials, and emergency managers. Should be held at public and college libraries.

Chleborad, A. F.; Schuster, R. L., 1990, Ground failure associated with the Puget Sound region earthquakes of April 13, 1949, and April 29, 1965: U.S. Geological Survey Open-File Report 90-687, 136 p., 5 pl.

A thorough examination of the landslides, liquefaction, and other ground failures associated with the 1949 and 1965 earthquakes. The 1949 earthquake probably triggered a landslide at the Tacoma Narrows that caused an 8-foot-high tsunami in Puget Sound.

Dinkelman, Lisa; Holmes, M. L., 1993, Wild waves—Tsunamis in Puget Sound [abstract]. *In* University of Washington Quaternary Research Center, Large earthquakes and active faults in the Puget Sound region: University of Washington Quaternary Research Center, [1 p., unpaginated].

A brief description of a computer model of the underwater movement caused by earthquake on the Seattle fault 1,100 years ago. This model was then used to generate a numerical simulation of the resulting tsunami and to estimate the potential wave heights and wave-train periods along several locations on Puget Sound.

Garcia, A. W.; Houston, J. R., 1975, Type 16 flood insurance study—Tsunami predictions for Monterey and San Francisco Bays and Puget Sound: U.S. Army Engineer Waterways Experiment Station, Technical Report H-75-17, 1 v.

A thorough study conducted to determine 100- and 500-year runup due to tsunamis of distant origin for the Strait of Juan de Fuca, Puget Sound, and areas of the California coast.

Hemphill-Haley, Eileen, 1996, Diatoms as an aid in identifying late-Holocene tsunami deposits: Holocene, v. 6, no. 4, p. 439-448.

These single-celled aquatic plants in tsunami deposits provide compelling new evidence for tsunami research.

Holmes, M. L.; Dinkelman, Lisa, 1993, Modeling paleotsunamis in Puget Sound, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 25, no. 6, p. A-289–A-290.

A brief description of a computer model to assess the potential of damaging tsunamis or seiches from earthquakes on the Seattle fault or from other earthquakes in the Puget Lowland.

Huntley, D. J.; Clague, J. J., 1996, Optical dating of tsunami-laid sands: Quaternary Research, v. 46, no. 2, p. 127-140.

A new dating technique is tested on tsunami deposits on Vancouver Island and in Cultus Bay.

Recommended for geologists.

Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690–1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, 265 p.

This exhaustive catalog documents tsunamis that have struck the U.S. and its territorial possessions since 1690. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for college and large public libraries.

Lewarch, D. E.; Stein, J. K.; Larson, L. L., 1994, Use of the West Point, Seattle archaeological sequence to date late Holocene sea level rise and earthquake events in S. Puget Sound [abstract]: Geological Society of America Abstracts with Programs, v. 26, no. 7, p. A-157.

An archaeological site in Seattle helps to date the 1,000 to 1,100 year earthquake and accompanying tsunami.

Mohrig, D. C.; Moore, A. L., 1995, Reconstructing the depth and velocity of flow associated with deposition of suspended sediment during tsunami runup [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 25.

A brief report on the tsunami deposits in Cultus Bay.

Moore, A. L., 1993, Evidence for a tsunami in Puget Sound [abstract]. *In* University of Washington Quaternary Research Center, Large earthquakes and active faults in the Puget Sound region: University of Washington Quaternary Research Center, [1 p., unpaginated].

A brief report on the sand layers in Seattle and on Whidbey Island that may have been deposited by a tsunami generated by the earthquake 1,100 years ago on the Seattle fault.

Moore, A. L.; Mohrig, D. C., 1994, Size estimate of a 1000-year-old Puget Sound tsunami [abstract]: Geological Society of America Abstracts with Programs, v. 26, no. 7, p. A-522–A-523.

A brief summary of tsunami deposits at Cultus Bay.

Murty, T. S.; Hebenstreit, G. T., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America, Part 2—Strait of Georgia, Juan de Fuca Strait, and Puget Sound: Marine Geodesy, v. 13, no. 3, p. 189-209.

A computer model of the maximum size of tsunamis generated by earthquakes along the Strait of Georgia, Strait of Juan de Fuca, and in Puget Sound (GFP model). The results showed that whereas large tsunami amplitudes can occur on the outer coast, inside the GFP system, no major tsunami will result unless the earthquake occurs in the system itself.

Recommended for local planners, emergency managers, and college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Numerical simulation of tsunami amplitudes on the coast of British Columbia due to local earthquakes: Science of Tsunami Hazards, v. 8, no. 2, p. 97-127.

Thorough, detailed report of computer simulations of tsunamis along the Pacific Coast, the Strait of Juan de Fuca, and Puget Sound.

Recommended for engineers and for college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Simulation of tsunamis from great earthquakes on the Cascadia subduction zone: Science, v. 250, no. 4985, p. 1248-1251.

A computer model of a tsunami generated by a hypothetical earthquake of magnitude 8.5 off Washington and British Columbia. The calculations quantify the tsunami risk and identify the factors that would determine flooding levels along the adjacent coast, the Strait of Georgia, and Puget Sound.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Sherrod, B. L., 1995, Microfossil comparisons from two suspected tsunami deposits in Puget Sound, Washington [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 16.

Brief report of research to date and identify tsunami deposits on Whidbey Island.

Thorsen, G. W., 1988, Overview of earthquake-induced water waves in Washington and Oregon: Washington Geologic Newsletter, v. 16, no. 4, p. 9-18.

An excellent article about the historic damage and the potential hazard from tsunamis in Washington and Oregon.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

Troost, K. G., 1994, Dating earthquakes, subsidence, and sea level rise, using archaeological data at West Point, Seattle, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 26, no. 7, p. A-157.

An archaeological site in Seattle helps to date the 1,000 to 1,100-year-old earthquake and accompanying tsunami.

VI. WORKS ABOUT TSUNAMI HAZARDS IN THE STRAIT OF JUAN DE FUCA

Garcia, A. W.; Houston, J. R., 1975, Type 16 flood insurance study—Tsunami predictions for Monterey and San Francisco Bays and Puget Sound: U.S. Army Engineer Waterways Experiment Station, Technical Report H-75-17, 1 v.

A thorough study conducted to determine 100- and 500-year runup due to tsunamis of distant origin for the Strait of Juan de Fuca, Puget Sound, and areas of the California coast.

Recommended for local planners, emergency managers, and college libraries.

Hutchinson, Ian; McMillan, A. D., 1997, Archaeological evidence for village abandonment associated with late Holocene earthquakes at the northern Cascadia subduction zone: Quaternary Research, v. 48, no. 1, p. 79-87.

A thorough archaeological study of village sites on Vancouver Island, the Neah Bay-Cape Flattery area, and coast of the Strait of Juan de Fuca.

Recommended for local planners, emergency managers, and college libraries.

Barlow, D. P., 1993, Tsunami hazards—A background to regulation: British Columbia Ministry of Environment, Lands and Parks, Floodplain Management Branch, 48 p.

An overview of information about Pacific coast tsunamis and the means of limiting damage as a background to development of tsunami flood damage reduction policies for the British Columbia coast.

Highly recommended for local planners and emergency managers.

Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690–1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, 265 p.This exhaustive catalog documents tsunamis that have struck the U.S. and its territorial possessions since 1690. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for college and large public libraries.

Murty, T. S.; Hebenstreit, G. T., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America, Part 2—Strait of Georgia, Juan de Fuca Strait, and Puget Sound: Marine Geodesy, v. 13, no. 3, p. 189-209.

A computer model of the maximum size of tsunamis generated by earthquakes along the Strait of Georgia, Strait of Juan de Fuca, and in Puget Sound (GFP model). The results showed that whereas large tsunami amplitudes can occur on the outer coast, inside the GFP system, no major tsunami will result unless the earthquake occurs in the system itself.

Recommended for local planners, emergency managers, and college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Numerical simulation of tsunami amplitudes on the coast of British Columbia due to local earthquakes: Science of Tsunami Hazards, v. 8, no. 2, p. 97-127.

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Recommended for engineers and for college libraries.

Thorsen, G. W., 1988, Overview of earthquake-induced water waves in Washington and Oregon: Washington Geologic Newsletter, v. 16, no. 4, p. 9-18.

An excellent article about the historic damage and the potential hazard from tsunamis in Washington and Oregon.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

VII. WORKS ABOUT TSUNAMI HAZARDS IN OTHER PARTS OF THE CASCADIA SUBDUCTION ZONE

Ansevin, Andrea; Good, J. W., 1993, A strategy for improving coastal natural hazards management—Oregon's policy working group approach. *In* Magoon, O. T.; Wilson, W. S.; Converse, Hugh; Tobin, L. T., editors, Coastal zone '93; Proceedings of the 8th symposium on coastal and ocean management: American Society of Civil Engineers, v. 3, p. 2829-2841.

Describes the coastal natural hazards in Oregon, how the present coastal policies are working, and how problems with the current framework are being addressed.

Atwater, B. F.; Nelson, A. R.; Clague, J. J.; Carver, G. A.; Yamaguchi, D. K.; Bobrowsky, P. T.; Bourgeois, Joanne; Palmer, S. P.; and others, 1995, Summary of coastal geologic evidence for past great earthquakes at the Cascadia subduction zone: Earthquake Spectra, v. 11, no. 1, p. 1-18.

A thorough review of the geologic evidence of great earthquakes on the Cascadia subduction zone, from the research conducted from 1985 through 1995. Includes an excellent bibliography of that work.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Barlow, D. P., 1993, Tsunami—Annotated bibliography; Version 2: British Columbia Ministry of Environment, Lands and Parks, Floodplain Management Branch, 36 p.

A very thorough annotated bibliography about tsunami hazards in British Columbia, tsunami modeling, flood insurance, floodplain management, and coastal zone management.

This exhaustive catalog documents tsunamis that have struck the U.S. and its territorial possessions since 1690. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for college and large public libraries.

Benson, B. E.; Grimm, K. A.; Clague, J. J., 1997, Tsunami deposits beneath tidal marshes on northwestern Vancouver Island, British Columbia: Quaternary Research, v. 48, no. 2, p. 192-204.

This thorough study found that two sand sheets underlying marsh sediments on northern Vancouver Island were probably deposited by tsunamis. The lower layer may be associated with an event about 1700 off the coast of Washington.

Recommended for geologists.

Berkman, S. C.; Symons, J. M., 1960?, The tsunami of May 22, 1960 as recorded at tide stations: U.S. Coast and Geodetic Survey, 69 p.

Tide gage readings for this tsunami from around the Pacific Ocean, including the stations at Neah Bay, Friday Harbor, and Echo Bay.

Bobrowsky, P. T.; Clague, J. J., 1995, Tsunami deposits beneath tidal marshes on Vancouver Island, British Columbia, Canada [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 12.

Brief report of current research to identify tsunami deposits on Vancouver Island.

Carver, D. H.; Carver, G. A., 1996, Earthquake and thunder—Native oral histories of paleoseismicity along the southern Cascadia subject zone [abstract]: Geological Society of America Abstracts with Programs, v. 28, no. 5, p. 54.

Great subduction earthquakes are part of the oral history and tradition of southern Cascadia coastal tribes. Those stories include accounts of a strong subduction zone earthquake that produced strong shaking, aftershocks, liquefaction, coseismic subsidence, and tsunami inundation.

Recommended for local planners and emergency managers.

Carver, G. A.; Peterson, C. D.; Garrison, C. E.; Koehler, R., 1996, Paleotsunami evidence of subduction earthquakes from northern California [abstract]: Geological Society of America Abstracts with Programs, v. 28, no. 5, p. 55.

Cores from about 40 marsh sites show at least 10 prehistoric tsunami sand layers in peaty sediments that span about 2,000 years.

Clague, J. J., 1991, Natural hazards. *In* Gabrielse, H.; Yorath, C. J., editors, Geology of the Cordilleran orogen in Canada: Geological Survey of Canada Geology of Canada 4; Geological Society of America DNAG Geology of North America, v. G-2, p. 803-815.

An overview of the earthquake, landslide, tsunami, and volcanic hazards in western Washington and British Columbia.

Clague, J. J., 1995, Early historical and ethnographical accounts of large earthquakes and tsunamis on western Vancouver Island, British Columbia: Geological Survey of Canada Current Research 1995-A, p. 47-50.

The oral histories of tribes in British Columbia include accounts of great earthquakes and tsunamis; three such accounts are given in full.

Recommended for local planners and emergency managers.

Clague, J. J.; Bobrowsky, P. T., 1994, Evidence for a large earthquake and tsunami 100–400 years ago on western Vancouver Island, British Columbia: Quaternary Research, v. 41, no. 2, p. 176-184.

A thorough report on the geologic evidence for a large event on western Vancouver Island. The coastal sites had evidence of subsidence, tsunami deposits, and uplift.

Recommended for geologists.

Clague, J. J.; Bobrowsky, P. T.; Hutchinson, I.; Mathewes, R. W., 1998, Geological evidence for past large earthquakes in southwest British Columbia. *In* Geological Survey of Canada, Cordillera and Pacific Margin: Geological Survey of Canada Current Research 1998-A, p. 217-224.

A report on the geologic evidence of earthquakes, subsidence, and tsunamis, in many locations on Vancouver Island.

Recommended for geologists, local planners, and emergency managers.

Darienzo, M. E.; Peterson, C. D., 1990, Episodic tectonic subsidence of late Holocene salt marshes, northern Oregon central Cascadia margin: Tectonics, v. 9, no. 1, p. 1-22.

Six events of marsh burial in the last several thousand years are recorded in subsurface deposits in Netarts Bay, Oregon. Five of these include tsunami deposits or tidal mud flat deposits.

Recommended for local planners, emergency managers, and college libraries.

Good, J. W., 1995, Tsunami education planning workshop findings and recommendations: U.S. National Oceanic and Atmospheric Administration Pacific Marine Environmental Laboratory NOAA Technical Memorandum ERL PMEL-106, 41 p.

Recommends specific actions to improve public awareness and agency cooperation.

Required reading for all tsunami-area local planners and emergency managers; should be deposited in all tsunami-area public and college libraries.

Good, J. W.; Ridlington, S. S., editors, 1992, Coastal natural hazards—Science, engineering, and public policy: Oregon Sea Grant Program, 162 p.

Excellent papers about coastal hazards from earthquakes, tsunamis, landslides, and erosion, as well as papers about coastal engineering and public policy. Focuses on the Pacific coast of Oregon, with applications to the entire Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Hebenstreit, G. T.; Murty, T. S., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America; Part 1—The outer coast: Marine Geodesy, v. 13, no. 2, p. 101-146.

A computer model of the maximum size of tsunamis generated by earthquakes along the Pacific coasts of British Columbia, Washington, and Oregon. The results showed that large tsunami amplitudes can occur on the outer coast.

Recommended for local planners, emergency managers, and college libraries.

Hemphill-Haley, Eileen, 1996, Diatoms as an aid in identifying late-Holocene tsunami deposits: Holocene, v. 6, no. 4, p. 439-448.

These single-celled aquatic plants in tsunami deposits provide compelling new evidence for tsunami research.

Hull, D. A.; Karel, Angie, 1997, Strategy for tsunami mitigation and public awareness: Oregon Department of Geology and Mineral Industries, 1 v.

Addresses the tsunami mitigation and public awareness efforts in Oregon.

Highly recommended for state and local planners, legislators, and emergency managers.

Humboldt Earthquake Education Center, 1995, Living on shaky ground—How to survive earthquakes and tsunamis on the North Coast: Humboldt Earthquake Education Center, 24 p.

An excellent consumer guide for understanding earthquakes and tsunamis of the Cascadia subduction zone.

Highly recommended for local planners and emergency managers.

Huntley, D. J.; Clague, J. J., 1996, Optical dating of tsunami-laid sands: Quaternary Research, v. 46, no. 2, p. 127-140.

A new dating technique is tested on tsunami deposits on Vancouver Island and in Cultus Bay.

Recommended for geologists.

Hutchinson, Ian; McMillan, A. D., 1997, Archaeological evidence for village abandonment associated with late Holocene earthquakes at the northern Cascadia subduction zone: Quaternary Research, v. 48, no. 1, p. 79-87.

A thorough archaeological study of village sites on Vancouver Island, the Neah Bay–Cape Flattery area, and coast of the Strait of Juan de Fuca.

Recommended for local planners, emergency managers, and college libraries.

Jacoby, G. C.; Bunker, D. E.; Benson, B. E., 1997, Tree-ring evidence for an A.D. 1700 Cascadia earthquake in Washington and northern Oregon: Geology, v. 25, no. 11, p. 999-1002, Data Depository item 9756.

Careful tree ring dating provides additional evidence that a great Cascadia subduction zone earthquake occurred in 1700.

Kanamori, Hiroo; Heaton, T. H., 1996, The wake of a legendary earthquake: Nature, v. 379, no. 6562, p. 203-204.

A good summary of the evidence for Cascadia subduction zone earthquakes and the 1700 event and tsunami.

Recommended as a first introduction to the subjects.

Kelsey, H. M.; Nelson, A. R.; Hemphill-Haley, Eileen, 1995, Properties and depositional characteristics of tsunamis in south coastal Oregon from a paired coastal-lake and marsh study [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 20.

A brief comparison of tsunami deposits in a coastal lake and a coastal estuary in Oregon.

Kerr, R. A., 1995, Faraway tsunami hints at a really big Northwest quake: Science, v. 267, no. 5200, p. 962.

A general-interest account of the deduction for the date of the 1700 event.

Recommended as a first introduction to the subject

Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690–1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, 265 p.

This exhaustive catalog documents tsunamis that have struck the U.S. and its territorial possessions since 1690. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for college and large public libraries.

Lander, J. F.; Lockridge, P. A.; Kozuch, M. J., 1993, Tsunamis affecting the west coast of the United States, 1806–1992: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 29, 243 p.

This exhaustive catalog documents tsunamis that struck the west coast of the U.S. Gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for tsunami scientists and college and large public libraries.

Murty, T. S.; Crean, P. B., 1986, Numerical simulation of the tsunami of June 23, 1946 in British Columbia, Canada: Science of Tsunami Hazards, v. 4, no. 1, p. 15-24.

Computer model reconstruction of the tsunami that occurred on Vancouver Island in 1946. The numerically simulated results on the amplitudes of the tsunami waves and the travel times are in good agreement with the few available observations.

Recommended for local planners and emergency managers.

Nelson, A. R.; Kelsey, H. M.; Hemphill-Haley, Eileen; Witter, R. C., 1996, A 7500-yr lake record of Cascadia tsunamis in southern coastal Oregon [abstract]: Geological Society of America Abstracts with Programs, v. 28, no. 5, p. 95.

A brief report on a 7,500-year record of tsunami deposits in coastal lakes of Oregon. Such lake records reflect more uniform and continuous sedimentation and have stronger contrasts between marine and freshwater fossils than do stratigraphic records from tidal marshes.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1992, Tsunami threat to the Pacific coast of Canada due to local earthquakes: Natural Hazards, v. 5, no. 2, p. 205-210.

Computer modeling for tsunami hazard from a hypothetical earthquake on the northern Cascadia subduction zone.

Recommended for local planners and emergency managers.

Obee, Bruce, 1989, Tsunami!: Canadian Geographic, v. 109, no. 1, p. 46-53.

A popular report about tsunamis in British Columbia

Recommended for local planners, emergency managers, high school libraries, and public libraries.

Oppenheimer, D. H.; Beroza, G.; Carver, G. A.; Dengler, L. A.; Eaton, J. P.; Gee, L.; Gonzalez, F.; Jayko, A. S.; Li, W. H.; Lisowski, Michael; and others, 1993, The Cape Mendocino, California, earthquakes of April 1992—Subduction at the triple junction: Science, v. 261, no. 5120, p. 433-438.

In 1992 an earthquake (magnitude 7.1) at Cape Mendocino, California occurred at the intersection of three tectonic plates at the south end of the Cascadia subduction zone, producing coastal uplift and a small tsunami. This earthquake has important implications for the seismic hazard of the Cascadia subduction zone region.

Recommended for local planners and emergency managers.

Oregon Geology, 1997, Center for the Tsunami Inundation Mapping Effort (TIME) dedicated at Hanfield Maine Science Center in Newport: Oregon Geology, v. 59, no. 4, p. 96-97.

News report on the opening of this research center, with information about the funding and administration of the tsunami research efforts.

Peterson, C. D.; Darienzo, M. E.; Clough, C. M.; Baptista, A. M., 1991, Paleo-tsunami evidence in northern Oregon bays of the central Cascadia margin—Final technical progress report: Oregon Department of Geology and Mineral Industries, 31 p.

A compilation of available evidence of paleo-tsunami deposits from 10 Oregon bays.

Peterson, C. D.; Priest, George, 1992, Catastrophic coastal hazards in the Cascadia margin U.S. Pacific Northwest. *In* Good, J. W.; Ridlington, S. S., editors, Coastal natural hazards—Science, engineering, and public policy: Oregon Sea Grant Program, p. 33-37.

Describes coastal hazards from the effects of a great subduction zone earthquake (subsidence, liquefaction, and tsunami inundation), as well as beach erosion by storms. Emphasizes the need for site-specific information for hazard mitigation.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Peterson, C. D.; Priest, G. R., 1995, Preliminary reconnaissance survey of Cascadia paleotsunami deposits in Yaquina Bay, Oregon: Oregon Geology, v. 57, no. 2, p. 33-40.

Evidence of tsunami deposits was found in at least 14 marsh sites in Yaquina Bay, Oregon. For a more extensive report on this project, see Priest and others, 1997.

Peterson, C. D.; Priest, G. R., 1996, Paleotsunami barrier-overtopping—One piece of the puzzle [abstract]: Oregon Geology, v. 58, no. 4, p. 96-97.

Brief report on tsunami waves that top coastal barriers, such as dunes.

Preuss, Jane, 1994, Regional planning implications of tsunami risk [abstract]: Eos (American Geophysical Union Transactions), v. 75, no. 3, Supplement, p. 25.

Brief update to Preuss's ongoing studies of urban planning to reduce tsunami risk.

Preuss, Jane; Priest, G. R., 1997, Tsunami hazard mitigation and counter measures with an example from Oregon. *In* Gusiakov, V. K., editor, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, p. 43-46.

Briefly describes four parallel approaches of Oregon's tsunami hazard mitigation program: public education, inundation mapping, limiting construction in inundation zones, warning systems.

Highly recommended for local planners, emergency managers, government officials, citizens, public libraries, and college libraries.

Priest, G. R., 1995, Tsunami hazard map of the ______ quadrangle, ______ County, Oregon: Oregon Department of Geology and Mineral Industries Open File Report O-95-__, 1 sheet, scale 1:24,000. [Plug in the names and numbers from below.]

Preliminary inundation maps have been prepared for these coastal quadrangles:

Astoria quadrangle, Clatsop County: OFR O-95-10
Bandon quadrangle, Coos County: OFR O-95-51
Bill Peak quadrangle, Coos County: OFR O-95-52
Brookings quadrangle, Curry County: OFR O-95-65
Bullards quadrangle, Coos County: OFR O-95-49
Cape Arago quadrangle, Coos County: OFR O-95-46
Cape Blanco quadrangle, Curry County: OFR O-95-55
Cape Sebastian quadrangle, Curry County: OFR O-95-61
Carpenterville quadrangle, Curry County: OFR O-95-64
Cathlamet Bay quadrangle, Clatsop County: OFR O-95-11
Charleston quadrangle, Coos County: OFR O-95-47
Coos Bay quadrangle, Coos County: OFR O-95-48
Depoe Bay quadrangle, Lincoln County: OFR O-95-27
Devils Lake quadrangle, Lincoln County: OFR O-95-26
Empire quadrangle, Coos County: OFR O-95-44
Floras Lake quadrangle, Curry County: OFR O-95-53
Florence quadrangle, Lane County: OFR O-95-37
Gearhart quadrangle, Clatsop County: OFR O-95-13
Gold Beach quadrangle, Curry County: OFR O-95-59
Goose Pasteur quadrangle, Lane County: OFR O-95-36
Heceta Head quadrangle, Lane County: OFR O-95-34
Knappa quadrangle, Clatsop County: OFR O-95-12
Lakeside quadrangle, Coos and Douglas Counties: OFR O-95-43
Langlois quadrangle, Curry and Coos Counties: OFR O-95-54
Lincoln City quadrangle, Lincoln County: OFR O-95-25
Mack Point quadrangle, Curry County: OFR O-95-63
Mercer Lake quadrangle, Lane County: OFR O-95-35
Mount Emily quadrangle, Curry County: OFR O-95-66
Nehalem quadrangle, Tillamook County: OFR O-95-17
Neskowin quadrangle, Tillamook and Lincoln Counties: OFR O-95-24
Newport North quadrangle, Lincoln County: OFR O-95-28
Newport South quadrangle, Lincoln County: OFR O-95-29
North Bend quadrangle, Coos County: OFR O-95-45
Ophir quadrangle, Curry County: OFR O-95-58
Olney quadrangle, Clatsop County: OFR O-95-14

Port Orford quadrangle, Curry County: OFR O-95-57

Reedsport quadrangle, Douglas County: OFR O-95-32

Riverton quadrangle, Coos County: OFR O-95-50

Signal Buttes quadrangle, Curry County: OFR O-95-60

Sixes quadrangle, Curry County: OFR O-95-56

Sundown Mountain quadrangle, Curry County: OFR O-95-62

Tahkenitch Creek quadrangle, Douglas and Lane Counties: OFR O-95-38

Tidewater quadrangle, Lincoln County: OFR O-95-32

Toledo South quadrangle, Lincoln County: OFR O-95-30

Waldport quadrangle, Lincoln County: OFR O-95-31

Warrenton quadrangle, Clatsop County: OFR O-95-09

Winchester Bay quadrangle, Douglas County: OFR O-95-31

Yachats quadrangle, Lincoln and Lane County: OFR O-95-33

Priest, G. R., 1997, Update on tsunamic mapping progress in Oregon: Oregon Geology, v. 59, no. 4, p. 97.

News report on the progress of this research.

Priest, G. R.; Myers, Edward P., III; Baptista, Antonio M.; Fleuck, Paul; Wang, Kelin; Kamphaus, Robert A.; Peterson, C. D., 1997, Cascadia subduction zone tsunamis—Hazard mapping at Yaquina Bay, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-97-34, 144 p.

A thorough report on the research project to assess tsunami hazards at Yaquina Bay, Oregon (funded by the USGS NEHRP program).

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., editors, 1996, Assessing earthquake hazards and reducing risk in the Pacific Northwest: U.S. Geological Survey Professional Paper 1560, 306 p., 6 plates.

This volume includes eleven highly significant papers about earthquakes in the Pacific Northwest.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Includes:

Rogers, A. M.; Walsh, T. J.; Kockelman, W. J.; Priest, G. R., 1996, Earthquake hazards in the Pacific Northwest—An overview. p. 1-54.

The introduction to the volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Walsh, T. J., 1996, An introduction to earthquakes sources of the Pacific Northwest. p. 71-74.

Discusses the general earthquake setting in the Pacific Northwest and summarizes the findings of papers in this volume.

Highly recommended for geologists, local planners, emergency managers, public libraries, and college libraries.

Rogers, G. C., 1988, An assessment of the megathrust potential of the Cascadia subduction zone: Canadian Journal of Earth Sciences, v. 25, no. 6, p. 844-852.

Describes the tectonic setting of the Cascadia subduction zone

Recommended for local planners, emergency managers, and college libraries.

Satake, Kenji; Bourgeois, Joanne; Reinhart, M. A., 1994, Tsunami heights in the Pacific Northwest from Cascadia subduction earthquakes. *In* Prentice, C. S.; Schwartz, D. P.; Yeats, R. S., conveners, Proceedings of the Workshop on Paleoseismology, 18–22 September 1994, Marshall, California: U.S. Geological Survey Open-File Report 94-568, p. 163-165.

Computations of crustal deformation and tsunamis for four hypothetical great earth- quakes along the Cascadia subduction zone. The model indicates wave heights of more than 10 m in some areas from a M9 event. Those computations were then compared to the geologic evidence of paleo-tsunamis in coastal and estuarine sediments in southwest Washington.

Satake, Kenji; Shimazaki, Kunihiko; Tsuji, Yoshinobu; Ueda, Kazue, 1996, Time and size of a giant earthquake in Cascadia inferred from Japanese tsunami records of January 1700: Nature, v. 379, no. 6562, p. 246-249.

This report points to a precise time for the most recent major event on the Cascadia subduction zone: about 9 p.m., January 26, 1700, from careful analysis of historical records of tsunami inundation in Japan.

Highly recommended for local planners and emergency managers; should be held at public and college libraries.

Schatz, C. E., 1965, Source and characteristics of the tsunami observed along the coast of the Pacific Northwest on March 28, 1964: Oregon State University Master of Science thesis, 39 p.

The mechanism and effects of the 1964 tsunami, along the Pacific Coast.

Recommended for local planners, emergency managers, and college libraries.

Sokolowski, T. J., 1996, Realignment of services in the Tsunami Warning System [abstract]: PanPacific Hazard '96, Abstracts [downloaded Sept. 28, 1996, from http://hoshi.cic.sfu.ca/~anderson/hazards96/], 1 p.

Description of technical enhancements at the Alaska Tsunami Warning Center.

Synolakis, C. E., 1995, Tsunami prediction [letter]: Science, v. 270, no. 5233, p. 15-16.

A letter questioning the validity of the model indicating that the Japanese tsunami of 1700 was caused by an event on the Cascadia subduction zone.

Recommended for tsunami modelers.

Synolakis, C. E.; Liu, Philip; Carrier, George; Yeh, Harry, 1997, Tsunamigenic sea-floor deformations: Science, v. 278, no. 5338, p. 598-600.

Describes some of the variables that complicate tsunami modeling, as presented at a 1997 workshop.

Recommended for tsunami modelers.

Thorsen, G. W., 1988, Overview of earthquake- induced water waves in Washington and Oregon: Washington Geologic Newsletter, v. 16, no. 4, p. 9-18.

An excellent article about the historic damage and the potential hazard from tsunamis in Washington and Oregon.

Highly recommended for local planners, emergency managers, public libraries, and high school and college libraries.

University of Washington Quaternary Research Center, 1995, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, 37 p.

Summaries of the 29 papers presented at this 1995 conference.

Visher, Paul, 1995, Tsunami disaster planning in Clatsop County, Oregon [abstract]. *In* University of Washington Quaternary Research Center, Tsunami deposits—Geologic warnings of future inundation: University of Washington Quaternary Research Center, p. 36-37.

Brief report of current tsunami planning efforts in coastal Oregon.

Recommended for local planners and emergency managers.

White, W. R. H., 1966, The Alaska earthquake— Its effect in Canada: Canadian Geographical Journal, v. 72, no. 6, p. 210-219.

A contemporary report on the effects of the tsunami generated by the 1964 Alaska earthquake on the British Columbia coast.

Whitmore, P. M., 1994, Expected tsunami amplitudes off the Tillamook County, Oregon, coast following a major Cascadia subduction zone earthquake: Oregon Geology, v. 56, no. 3, p. 62-64.

Estimates of tsunami wave heights for 131 sites along the North American coast for tsunamis generated by Cascadia subduction zone earthquakes.

Recommended for tsunami modelers.

Whitmore, P. M., 1993, Expected tsunami amplitudes and currents along the North American coast for Cascadia subduction zone earthquakes: Natural Hazards, v. 8, no. 1, p. 59-73.

Estimates of tsunami wave heights for 131 sites along the North American coast for tsunamis generated by Cascadia subduction zone earthquakes.

Recommended for tsunami modelers.

Whitmore, P. M.; Sokolowski, T. J., 1996, Predicting tsunami amplitudes along the North American coast from tsunamis generated in the northwest Pacific Ocean during tsunami warnings: Science of Tsunami Hazards, v. 14, no. 3, p. 147-166.

Estimates of tsunami wave heights on the Pacific coast from earthquakes in Japan and other areas of the northwestern Pacific Ocean.

Recommended for tsunami modelers.

VIII. WORKS ABOUT TSUNAMI HAZARDS OUTSIDE OF THE CASCADIA SUBDUCTION ZONE

Bourgeois, Joanne; Reinhart, M. A., 1993, Tsunami deposits from 1992 Nicaragua event—Implications for interpretation of paleo-tsunami deposits, Cascadia subduction zone [abstract]: Eos (American Geophysical Union Transactions), v. 74, no. 43, Supplement, p. 350.

Tsunami deposits from the 1960 Chilean event and the 1992 Nicaragua event provide significant analogies for Cascadia.

Boyce, J. A., 1985, Tsunami hazard mitigation— The Alaskan experience since 1964: University of Washington Master of Arts thesis, 109 p.

Evaluates the steps taken by state and local government since 1964 to prepare Alaska's coastal communities for the next tsunami.

Highly recommended for local planners, emergency managers, public libraries, and college libraries.

California Governor's Office of Emergency Services, 1997, Findings and recommendations for mitigating the risks of tsunamis in California: California Governor's Office of Emergency Services, 30 p.

An excellent action plan for tsunami mitigation in California.

Highly recommended for local planners, emergency managers, public and college libraries.

Carte, G. W., 1981, Tsunami hazard and community preparedness in Alaska: U.S. National Oceanic and Atmospheric Administration Technical Memorandum NWS AR-29, 20 p.

An evaluation of the tsunami hazard for the Alaskan coast, the effectiveness of the Alaska Tsunami Warning System and the level of tsunami preparedness in individual Alaska coastal communities.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Gusiakov, V. K.; Marchuk, A. G., 1997, Estimation of tsunami risk—Case study for the Bering coast of Kamchatka. *In* Gusiakov, V. K., editor, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, p. 33-42.

Gives a mathematical model for tsunami risk.

Kanamori, Hiroo; Kikuchi, Masayuki, 1993, The 1992 Nicaragua earthquakes—A slow tsunami earthquake associated with subducted sediments: Nature, v. 361, no. 6414, p. 714-716.

Because the 1992 Nicaragua earthquake generated tsunamis were disproportionately large for its surface wave magnitude, the tsunami generation is better explained by examining the moment magnitude (7.6). The authors conclude that this was a slow thrust earthquake on a subduction interface. This has implications for tsunamis along the Cascadia subduction zone.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Kowalik, Z.; Murty, T. S., 1989, On some future tsunamis in the Pacific Ocean: Natural Hazards, v. 1, no. 4, p. 349-369.

Computer modeling of tsunamis generated by earthquakes in the Aleutian Islands and by a major eruption of St. Augustine volcano in Cook Inlet, Alaska.

Lander, J. F., 1996, Tsunamis affecting Alaska, 1737–1996: U.S. National Geophysical Data Center Key to Geophysical Research Documentation 31, 195 p.

A comprehensive compilation of Alaskan tsunamis.

Lander, J. F.; Lockridge, P. A.; Kozuch, M. J., 1993, Tsunamis affecting the west coast of the United States, 1806–1992: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 29, 243 p.

This exhaustive catalog documents tsunamis that struck the west coast of the U.S. It gives a scientific description of tsunamis and then describes the various tsunamis by region and year. Much of the material is based on local, historical, and eyewitness accounts.

Recommended for tsunami scientists and college and large public libraries.

Preuss, Jane, 1991, Urban planning for tsunami hazards—Grays Harbor, Washington and Lima, Peru. *In* Brennan, A. M.; Lander, J. F., editors, 2nd UJNR Tsunami Workshop, Honolulu, Hawaii, 5–6 November 1990; Proceedings: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 24, p. 203-218.

Compares the projected effects of a major tsunami on the cities of Grays Harbor, Washington, and Lima, Peru. The author uses urban planning methodology that first defines the specific tsunami threat, the local vulnerability patterns, and the secondary hazards, then uses microzonation for risk reduction.

Highly recommended for local planners, emergency managers, public libraries, and college libraries.

Satake, Kenji; Shimazaki, Kunihiko; Tsuji, Yoshinobu; Ueda, Kazue, 1996, Time and size of a giant earthquake in Cascadia inferred from Japanese tsunami records of January 1700: Nature, v. 379, no. 6562, p. 246-249.

This report points to a precise time for the most recent major event on the Cascadia subduction zone: about 9 p.m., January 26, 1700, from careful analysis of historic records of tsunami inundation in Japan.

Highly recommended for local planners and emergency managers; should be held at public and college libraries.

Walker, D. A., 1996, Human factors compounding the destructiveness of future tsunamis: Science of Tsunami Hazards, v. 14, no. 2, p. 79-83.

Makes strong arguments for improving public awareness of the hazards and improved communication among the public, the scientists, and government agencies as the best ways to reduce the disastrous effects of tsunamis.

Required reading for all tsunami researchers and planners.

IX. TSUNAMI MODELS AND MODELING

Barlow, D. P., 1993, Tsunami—Annotated bibliography; Version 2: British Columbia Ministry of Environment, Lands and Parks, Floodplain Management Branch, 36 p.

A very thorough annotated bibliography about tsunami hazards in British Columbia, tsunami modeling, flood insurance, flood plain management, and coastal zone management

Recommended for local planners, emergency managers, and college libraries.

Brennan, A. M.; Lander, J. F., editors, 1991, 2nd UJNR Tsunami Workshop, Honolulu, Hawaii, 5-6 November 1990; Proceedings: U.S. National Geophysical Data Center Key to Geophysical Records Documentation 24, 260 p.

These papers discuss of tsunami modeling and protective measures.

The full volume is recommended for modelers and engineers. The “protective measures” section is recommended for local planners, emergency managers, and college libraries.

Dinkelman, Lisa; Holmes, M. L., 1993, Wild waves—Tsunamis in Puget Sound [abstract]. In University of Washington Quaternary Research Center, Large earthquakes and active faults in the Puget Sound region: University of Washington Quaternary Research Center, [1 p., unpaginated].

A brief description of a computer model of the underwater movement caused by earthquake on the Seattle fault 1,100 years ago. This model was then used to generate a numerical simulation of the resulting tsunami and to estimate the potential wave heights and wave-train periods along several locations on Puget Sound.

Gusiakov, V. K.; Marchuk, A. G., 1997, Estimation of tsunami risk—Case study for the Bering coast of Kamchatka. *In* Gusiakov, V. K., editor, Tsunami mitigation and risk assessment—Report of the International Workshop, Petropavlovsk-Kamchatskiy, Russia, August 21–24, 1996: Russian Academy of Sciences, p. 33-42.

Gives a mathematical model for tsunami risk.

Hebenstreit, G. T.; Murty, T. S., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America; Part 1—The outer coast: Marine Geodesy, v. 13, no. 2, p. 101-146.

A computer model of the maximum size of tsunamis generated by earthquakes along the Pacific coasts of British Columbia, Washington, and Oregon. The results showed that large tsunami amplitudes can occur on the outer coast.

Recommended for local planners, emergency managers, and college libraries.

Holmes, M. L.; Dinkelman, Lisa, 1993, Modeling paleotsunamis in Puget Sound, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 25, no. 6, p. A-289–A-290.

A brief description of a computer model to assess the potential of damaging tsunamis or seiches from earthquakes on the Seattle fault or from other earthquakes in the Puget Lowland.

Kowalik, Z.; Murty, T. S., 1989, On some future tsunamis in the Pacific Ocean: Natural Hazards, v. 1, no. 4, p. 349-369.

Computer modeling of tsunamis generated by earthquakes in the Aleutian Islands and by a major eruption of St. Augustine volcano in Cook Inlet, Alaska.

Lander, J. F.; Yeh, Harry, conveners, 1995, Report of the International Tsunami Measurements Workshop: International Tsunami Measurements Workshop, 102 p.

Includes discussions and recommendations for instrumentation, modeling, and mitigation.

Recommended for local planners and emergency managers.

Murty, T. S.; Crean, P. B., 1986, Numerical simulation of the tsunami of June 23, 1946 in British Columbia, Canada: Science of Tsunami Hazards, v. 4, no. 1, p. 15-24.

Computer model reconstruction of the tsunami that occurred on Vancouver Island in 1946. The numerically simulated results on the amplitudes of the tsunami waves and the travel times are in good agreement with the few available observations.

Recommended for local planners and emergency managers.

Murty, T. S.; Hebenstreit, G. T., 1989, Tsunami amplitudes from local earthquakes in the Pacific Northwest region of North America, Part 2—Strait of Georgia, Juan de Fuca Strait, and Puget Sound: Marine Geodesy, v. 13, no. 3, p. 189-209.

A computer model of the maximum size of tsunamis generated by earthquakes along the Strait of Georgia, Strait of Juan de Fuca, and in Puget Sound (GFP model). The results showed that whereas large tsunami amplitudes can occur on the outer coast, inside the GFP system, no major tsunami will result unless the earthquake occurs in the system itself.

Recommended for local planners, emergency managers, and college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Numerical simulation of tsunami amplitudes on the coast of British Columbia due to local earthquakes: Science of Tsunami Hazards, v. 8, no. 2, p. 97-127.

Thorough, detailed report of computer simulations of tsunamis along the Pacific Coast, the Strait of Juan de Fuca, and Puget Sound.

Recommended for engineers and for college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1990, Simulation of tsunamis from great earthquakes on the Cascadia subduction zone: Science, v. 250, no. 4985, p. 1248-1251.

A computer model of a tsunami generated by a hypothetical earthquake of magnitude 8.5 off Washington and British Columbia. The calculations quantify the tsunami risk and identify the factors that would determine flooding levels along the adjacent coast, the Strait of Georgia, and Puget Sound.

Recommended for local planners, emergency managers, public libraries, and college libraries.

Ng, M. K.-F.; LeBlond, P. H.; Murty, T. S., 1992, Tsunami threat to the Pacific coast of Canada due to local earthquakes: Natural Hazards, v. 5, no. 2, p. 205-210.

Computer modeling for tsunami hazard from a hypothetical earthquake on the northern Cascadia subduction zone.

Recommended for local planners and emergency managers.

Priest, G. R., 1995, Tsunami hazard map of the ______ quadrangle, ______ County, Oregon: Oregon Department of Geology and Mineral Industries Open File Report O-95-__, 1 sheet, scale 1:24,000. [Plug in the names and numbers from below.]

Preliminary inundation maps have been prepared for these coastal quadrangles:

Astoria quadrangle, Clatsop County: OFR O-95-10
Bandon quadrangle, Coos County: OFR O-95-51
Bill Peak quadrangle, Coos County: OFR O-95-52
Brookings quadrangle, Curry County: OFR O-95-65
Bullards quadrangle, Coos County: OFR O-95-49
Cape Arago quadrangle, Coos County: OFR O-95-46
Cape Blanco quadrangle, Curry County: OFR O-95-55
Cape Sebastian quadrangle, Curry County: OFR O-95-61
Carpenterville quadrangle, Curry County: OFR O-95-64
Cathlamet Bay quadrangle, Clatsop County: OFR O-95-11
Charleston quadrangle, Coos County: OFR O-95-47
Coos Bay quadrangle, Coos County: OFR O-95-48
Depoe Bay quadrangle, Lincoln County: OFR O-95-27
Devils Lake quadrangle, Lincoln County: OFR O-95-26
Empire quadrangle, Coos County: OFR O-95-44
Floras Lake quadrangle, Curry County: OFR O-95-53
Florence quadrangle, Lane County: OFR O-95-37
Gearhart quadrangle, Clatsop County: OFR O-95-13
Gold Beach quadrangle, Curry County: OFR O-95-59
Goose Pasteur quadrangle, Lane County: OFR O-95-36
Heceta Head quadrangle, Lane County: OFR O-95-34
Knappa quadrangle, Clatsop County: OFR O-95-12
Lakeside quadrangle, Coos and Douglas Counties: OFR O-95-43
Langlois quadrangle, Curry and Coos Counties: OFR O-95-54
Lincoln City quadrangle, Lincoln County: OFR O-95-25
Mack Point quadrangle, Curry County: OFR O-95-63
Mercer Lake quadrangle, Lane County: OFR O-95-35
Mount Emily quadrangle, Curry County: OFR O-95-66
Nehalem quadrangle, Tillamook County: OFR O-95-17
Neskowin quadrangle, Tillamook and Lincoln Counties: OFR O-95-24
Newport North quadrangle, Lincoln County: OFR O-95-28
Newport South quadrangle, Lincoln County: OFR O-95-29
North Bend quadrangle, Coos County: OFR O-95-45
Ophir quadrangle, Curry County: OFR O-95-58

Olney quadrangle, Clatsop County: OFR O-95-14
Port Orford quadrangle, Curry County: OFR O-95-57
Reedsport quadrangle, Douglas County: OFR O-95-32
Riverton quadrangle, Coos County: OFR O-95-50
Signal Buttes quadrangle, Curry County: OFR O-95-60
Sixes quadrangle, Curry County: OFR O-95-56
Sundown Mountain quadrangle, Curry County: OFR O-95-62
Tahkenitch Creek quadrangle, Douglas and Lane Counties: OFR O-95-38
Tidewater quadrangle, Lincoln County: OFR O-95-32
Toledo South quadrangle, Lincoln County: OFR O-95-30
Waldport quadrangle, Lincoln County: OFR O-95-31
Warrenton quadrangle, Clatsop County: OFR O-95-09
Winchester Bay quadrangle, Douglas County: OFR O-95-31
Yachats quadrangle, Lincoln and Lane County: OFR O-95-33

Satake, Kenji; Bourgeois, Joanne; Reinhart, M. A., 1994, Tsunami heights in the Pacific Northwest from Cascadia subduction earthquakes. *In* Prentice, C. S.; Schwartz, D. P.; Yeats, R. S., conveners, Proceedings of the Workshop on Paleoseismology, 18–22 September 1994, Marshall, California: U.S. Geological Survey Open-File Report 94-568, p. 163-165.

Computations of crustal deformation and tsunamis were made for four hypothetical great earthquakes along the Cascadia subduction zone. The model indicates wave heights of more than 10 meters in some areas from a M9 event. Those computations were then compared to the geologic evidence of paleo-tsunamis in coastal and estuarine sediments in southwest Washington.

Synolakis, C. E., 1995, Tsunami prediction [letter]: Science, v. 270, no. 5233, p. 15-16.

A letter questioning the validity of the model indicating that the Japanese tsunami of 1700 was caused by an event on the Cascadia subduction zone.

Recommended for tsunami modelers.

Synolakis, C. E.; Liu, Philip; Carrier, George; Yeh, Harry, 1997, Tsunamigenic sea-floor deformations: Science, v. 278, no. 5338, p. 598-600.

Describes some of the variables that complicate tsunami modeling, as presented at a 1997 workshop.

Recommended for tsunami modelers.

Whitmore, P. M., 1993, Expected tsunami amplitudes and currents along the North American coast for Cascadia subduction zone earthquakes: Natural Hazards, v. 8, no. 1, p. 59-73.

Estimates of tsunami wave heights for 131 sites along the North American coast for tsunamis generated by Cascadia subduction zone earthquakes.

Recommended for tsunami modelers.

Whitmore, P. M.; Sokolowski, T. J., 1996, Predicting tsunami amplitudes along the North American coast from tsunamis generated in the northwest Pacific Ocean during tsunami warnings: Science of Tsunami Hazards, v. 14, no. 3, p. 147-166.

Estimates of tsunami wave heights on the Pacific coast from earthquakes in Japan and other areas of the northwestern Pacific Ocean.

Recommended for tsunami modelers.

Directory

There are four sections: Listings by individual, organization, state/province, and web page.

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TSUNAMI WEB PAGES

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NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH

http://nceer.eng.buffalo.edu

NATIONAL GEOPHYSICAL DATA CENTER

http://www.ngdc.noaa.gov/seg/hazard/resource/hazdir.html

Natural Hazards Data Resources Directory
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Geological Hazards
Meteorological Hazards
Societal Response
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http://www.ngdc.noaa.gov/seg/hazard/resource/tsudir.html

Tsunami Data and Information
links to:
International Tsunami Information Center
National Geophysical Data Center
Pacific Marine Environmental Laboratory

http://www.ngdc.noaa.gov/seg/hazard/tsu.html

Tsunami Data at NGDC
links to:
Tsunami Database
Tsunami Slide Sets
Tsunami Publications

http://www.ngdc.noaa.gov/seg/hazard/tsevsrch.html

Tsunami Event Database Search
Earthquake Parameters
Tsunami Source Parameters
Tsunami Event Parameters

NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM

http://www.pmel.noaa.gov/tsunami-hazard

OREGON SEA GRANT

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PACIFIC DISASTER CENTER

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PACIFIC NORTHWEST SEISMOGRAPHIC NETWORK

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PROVINCIAL EMERGENCY PROGRAM

http://hoshi.cic.sfu.ca/pep/toc.html

under Natural Hazard Preparedness
click on Tsunamis
scroll down, click on Tsunami "Web Library"
click on Tsunami Hazard Mitigation Committee
scroll down to Web Links

U.S. ARMY ENGINEERS WATERWAYS EXPERIMENT STATION

http://bigfoot.cerc.west.army.mil/tsu0000.htm

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